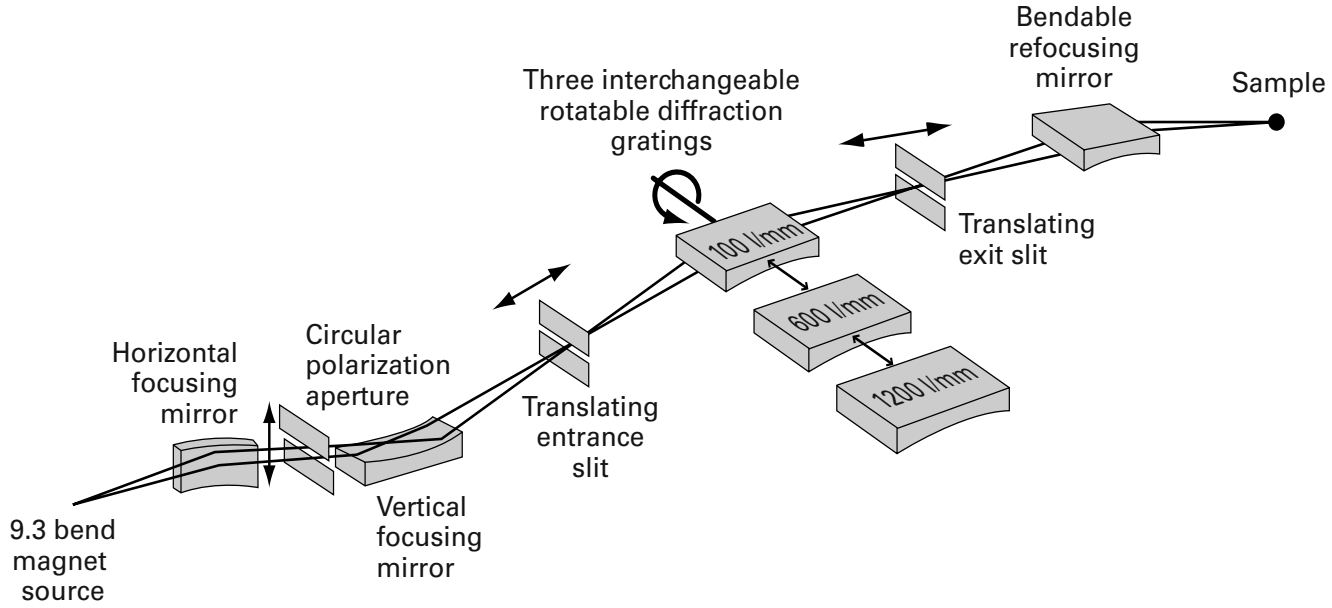
High-Resolution Spectroscopy and Circular Polarization • Beamline 9.3.2

Berkeley Lab • University of California

Beamline Specifications

Photon Energy Range (eV)	Photon Flux (photons/sec/0.1%BW)	Spectral Resolution (E/ΔE)	Spot Size (mm)	Polarization	Availability
30–1500	**~10^{11}** (dependent upon resolution & energy)	**≤8000** (selectable by slit width)	**0.5×1**	**Linear or Circular** (selectable with aperture)	**NOW**



***Schematic layout** of Beamline 9.3.2.*

Beamline 9.3.2 serves two experimental stations for high-resolution photoelectron and x-ray absorption spectroscopy of materials and surfaces with linearly and circularly polarized synchrotron radiation.

To share beamtime efficiently, the two stations are mounted on a platform that rotates without breaking vacuum, so that one station is in line to receive synchrotron light. The advanced photoelectron spectrometer/diffractometer (described in a separate data sheet) is permanently installed. The second station is removable. An applied materials chamber, an angle-resolved photoelectron spectroscopy chamber, or an independent user chamber may be installed in this location.

The beamline operates over the energy range from 30 to 1400 eV using a bend-magnet source and a spherical-grating, Rowland-circle monochromator (SGM) with three interchangeable gratings and translatable entrance and exit slits. Horizontal and vertical focusing before the monochromator is by means of crossed mirrors in the Kirkpatrick-Baez configuration. The resolution of the monochromator is selectable by means of variable entrance- and exit-slit widths. Spectral resolutions up to 8,000 can be achieved with a flux around

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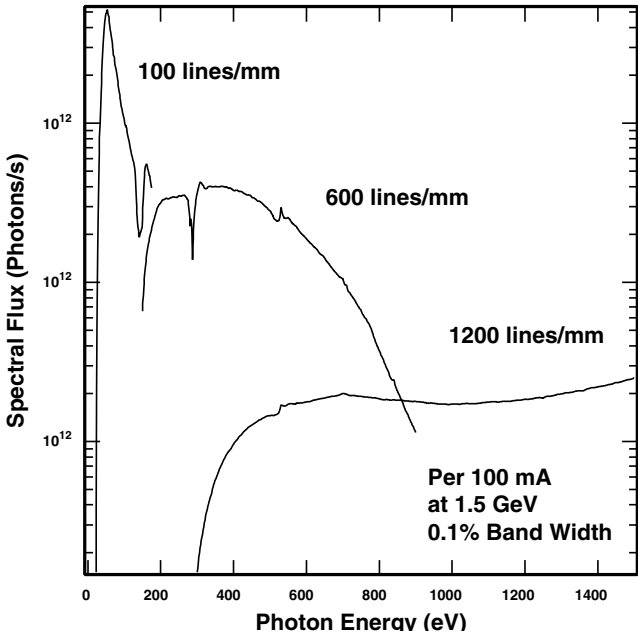
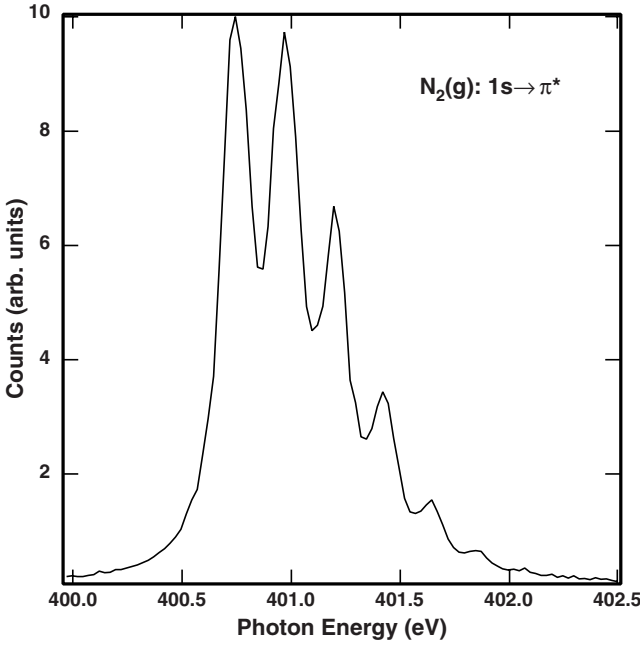
10^{12} photons/s for low photon energies (<200 eV), 10^{11} photons/s for intermediate energies, and 10^{10} photons/s for higher energies (>800 eV).

The polarization of the light is linear in the horizontal plane. A water-cooled, movable aperture in front of the vertical focusing mirror selects part of the beam above or below the plane to obtain circularly polarized light (80% at 700 eV with a loss in intensity of only one-third to one-quarter). ■



***Photon flux at a nominal resolving power** of 1,000. Three gratings with line densities of 100, 600, and 1200 lines/mm are used in the monochromator. The curves show the photon spectral flux for each grating at a resolving power of 1,000 over its full range, as measured with a gold photodiode downstream from the monochromator exit slit. Flux measurements were made at a beam energy of 1.5 GeV; flux values are normalized to a beam current of 100 mA. The failure of the flux from the high-energy grating to drop off may indicate a large scattered light component.*



***Near-edge absorption spectrum (NEXAFS).** Nitrogen K-edge gas-phase N_2 photoabsorption spectra showing the $1s \rightarrow \pi^*$ region corresponding to a monochromator resolving power ($E/\Delta E$) in excess of 7000. Data courtesy of Z. Hussain, P.A. Heimann, W. McKinney, and H.A. Padmore (ALS); W.R.A. Huff, S.A. Kellar, and E.J. Moler (ALS and University of California at Berkeley); C.S. Fadley (University of California at Davis and LBNL); and D.A. Shirley (The Pennsylvania State University) [J. Electron Spectroscopy 80, 401 (1996)].*

To obtain a proposal form, go to www-als.lbl.gov/als/quickguide/independinvest.html.

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